

Comment on wes-2022-15

Anonymous Referee #1

Referee comment on "Probabilistic temporal extrapolation of fatigue damage of offshore wind turbine substructures based on strain measurements" by Clemens Hübler and Raimund Rolfes, Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2022-15-RC1>, 2022

The paper deals with a timewise extrapolation of fatigue damage measured with strain gauges at the tower of an offshore wind turbine. The paper compares three approaches: simple extrapolation, binning method, machine learning. Although the methods itself are not new and have been published before, the paper is a useful contribution for comparison and validation of these approaches using a dataset of measurements. The research question is judged to be relevant and of high interest for industry within the context of aging offshore wind assets. The paper is very well written, easy to follow and well presented, a pleasure to read. However, I have three major concerns about the content of the paper:

- A main result of the paper is that 'wind speed' is the most important parameter for temporal extrapolation of fatigue damage. An important part of the storyline is that the paper uses data which is readily available over the life of the offshore wind turbine. However, the authors used mostly data from the met mast FINO1 to determine the wind speed. Most wind farms do not have access to a nearby met mast. The content of the paper is only useful, if the parameter 'wind speed' is purely extracted from SCADA (with acknowledgement of its limitations). Can you add the results for wind speed based on SCADA only?
- The authors use environmental conditions and the turbine status for damage extrapolation. However, they do not consider continuous operational SCADA data, such as power output and pitch angle (which may even be more robust parameters than wind speed). Can you explain why you do not take this data into account?
- I disagree with the conclusion that long-term extrapolation is possible even if the OWT has been modified. This may be the case for the example of this paper but a generalization can be wrong and dangerous. A change of operational conditions can have a significant effect on tower loads. For example, aerodynamic imbalance due to blade pitch misalignment increases tower loads. Such an imbalance may occur after some years of operation (e.g. after end of the measurement campaign) and stays often undetected. If such factors are not represented in the measurement period, the extrapolation will underestimate loads. Being unaware of such effects is, in my opinion,

the largest limitation of the presented extrapolation approach.

Please also see my detailed comments in the pdf attached.

Please also note the supplement to this comment:

<https://wes.copernicus.org/preprints/wes-2022-15/wes-2022-15-RC1-supplement.pdf>